

THE OXFORD COMPANION TO MEDICINE

Edited by
JOHN WALTON
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RONALD BODLEY SCOTT

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VOLUME II · N-Z

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A NOTE TO THE READER

Entries are listed in a simple letter-by-letter alphabetical order, with spaces, hyphens, and the definite and indefinite articles being ignored. Names beginning with Mc are ordered as if spelt Mac and St as if spelt Saint. In addition, biographies of individuals whose surnames have a prefix (de, van, von, etc.) occur under the capital letter of the main surname. The Companion contains a system of cross-references that is designed to inform the reader of related entries; this should be particularly useful for anyone less familiar with the more specialized medical vocabulary encountered in some of the entries. A cross-reference is shown in three ways: (i) by the use of an asterisk before a word (e.g. *biochemistry), indicating that there is an entry for that word; (ii) by the use of 'See' followed by the entry title in SMALL CAPITALS, indicating that further discussion will be found under that entry; and (iii) by the use of 'See also' followed by the entry title in SMALL CAPITALS, indicating that there is a related entry that might interest the reader. The cross-referencing does not attempt to be comprehensive but aims to guide the reader towards entries that might enhance the understanding of the entry being consulted. Thus the absence of a cross-reference does not necessarily imply that there is no related entry, and the reader may benefit from checking. A cross-reference is given the first time a particular word appears in an entry but not thereafter, regardless of the length of the entry (save in a few exceptional circumstances). In order to save space the titles of various entries have been abbreviated when they appear in cross-references. As a general rule SI units have been used throughout the text, and these units are described in the entry SI UNITS. Occasionally non-SI units have been used where this reflects common medical practice, for example, millimetres of mercury (mmHg) to record blood pressure. Appendix I contains a list of medical qualifications and Appendix II a list of common medical abbreviations. A list of main entries to be found within the Companion appears at the front of Volume I.

NATIONAL FORMULARY, BRITISH. See PHARMACY AND PHARMACISTS.

NATIONAL FORMULARY (USA). The *United States Pharmacopoeia* has been published since 1820, and has gone through many new editions. Its purpose has been to describe drugs regarded as appropriate and essential by the medical profession. Presently it is revised at five-year intervals, but supplements are issued when appropriate.

In 1888 the first *National Formulary* of unofficial preparations was published by the American Pharmaceutical Association. For some time the *Pharmacopoeia* was then looked upon as limited to the 'best' drugs, whereas the *Formulary* included some 'second best' agents, approved by some, but not all of the profession. Gradually a tendency developed for the *National Formulary* to emphasize the standards for inactive ingredients (excipients) used in making drug dosage forms. In 1975 the US Pharmacopoeial Convention, Inc., took over the publication of both reference works, and in 1980 they were published together in a single volume. This presented standards of strength, quality, and purity for about 2800 drugs. There is a Committee on Revision, which distributes proposed revisions for both publications, and invites comments before issuing supplements or new editions.

NATIONAL HEALTH INSURANCE ACT 1911.

Lloyd George's famous enactment represented a landmark in the development of state provision for health in the UK. Because of fierce opposition from the medical 'establishment', including the British Medical Association, the Act did not come into force on the appointed day (12 July 1912) but was delayed until the end of 1913. By this time there were 15000000 insured persons, and the government had recruited 10000 general practitioners willing to participate in the scheme. Under the Act, insured workers (wage earners with an income of less than 160 pounds per annum, excluding civil servants and teachers) but not their families, were entitled to free advice and treatment from 'panel doctors' and to sickness benefit paid through approved societies such as trade unions, workmen's clubs, etc. Hospital treatment for the seriously ill or injured was not included. Panel doctors were paid an annual capitation fee of 7s. 6d. per patient. Another pioneering feature of the Act was the provision of a subsidy for medical research of 1d. per patient per annum; from this modest beginning, the *Medical Research Council was eventually to emerge.

NATIONAL HEALTH SERVICE ACTS 1946, 1977.

The National Health Service (NHS), which came into being in the UK on 5 July 1948, was established by the National Health Service Act 1946. The latter followed, and was largely based on, the *Beveridge Report of 1942 and a subsequent government White Paper of 1944. It became:

the duty of the Minister of Health to promote the establishment in England and Wales of a comprehensive health service designed to secure improvement in the physical and mental health of the people and the prevention, diagnosis and treatment of illness and for that purpose to provide or secure the effective provision of a service in accordance with the provisions of the Act. Services so provided shall be free of charge, except where any provision of the Act expressly provides for the making and recovery of charges.

The NHS comprised: central administration; hospital and specialist services; the health services of local health authorities; general medical, dental, and pharmaceutical services; and mental health services. The administrative bodies for hospitals were Regional Hospital Boards, with Boards of Governors and Hospital Management Committees; those for general practice, Executive Councils; while the Local Health Authorities administered personal health services.

The 1946 Act, as amended, was superseded by the National Health Service Act 1977, which consolidated much of the law relating to the NHS in England and Wales and re-enacted many of the provisions of the *National Health Service (Reorganization) Act 1973.

NATIONAL HEALTH SERVICE (AMENDMENT) ACT 1949.

This Act made consequential amendments to the *National Health Service Act 1946, which after modification by the *National Health Service (Reorganization) Act 1973, was superseded by the *National Health Service Act 1977.

NATIONAL HEALTH SERVICE IN THE UK:

ITS STRUCTURE. The National Health Service (NHS) began on 5 July 1948, the appointed day on which the legislative measures of the first NHS Act of 1946 (1947 for Scotland) were brought into effect. The structure of the service established at that time remained unchanged until the reorganization of 1974 and its main feature was its three organizational branches, interdependent but unrelated below government level. The three branches provided a public health service, hospital and specialist services, and a framework for general practice provided by independent contractors. Certain health functions were retained at national level, for example the responsibility for the special hospitals (secure *psychiatric hospitals) which were administered directly for England and Wales by the then *Ministry of Health, continuing in 1985 to be the responsibility of the present *Department of Health and Social Security (DHSS). Such Ministerial responsibilities were not integral to the NHS which consisted from its inception, therefore, of services provided through its own national structure. There was no management link with a government department through which political accountability could be related to service activity.

The public health service. The public health service continued as before 1948 to be a responsi-

bility of local government with only some of the major component tiers of local government in the UK being identified as health authorities. Health functions were fulfilled by these health authorities through a committee system of authority members who had been elected by local government elections. The same authorities had to discharge substantial welfare responsibilities under the National Assistance Act 1948 and many combined health and welfare functions in their committees and in the duties of the officers concerned. The chief officer for health, and frequently therefore also for welfare, was the *Medical Officer of Health whose office involved him personally in certain statutory responsibilities for public health. Invested in the office was a significant level of independence derived from the right and duty of the Medical Officer of Health to report publicly on health matters, continuing the spirit of the historical development of public health and legislation from the previous century.

The public health service provided environmental health services, control measures for infectious diseases, maternity and child welfare services including vaccination and immunization, home nursing, school health services, and some other services concerned with occupational health and employment. The ambulance services (except in Scotland) were also a local authority responsibility. Welfare services included residential care for the elderly and the handicapped, and domiciliary support services for such individuals. At this time services for children were somewhat fragmented locally by responsibilities being shared between local authority health and education committees, sometimes separate welfare committees, and by the Home Office's local responsibilities towards children in such matters as parental rights, fostering and adoption. The Medical Officer of Health, either through the formal nature of his appointment to his own authority or through informal mechanisms of collaboration and persuasion, fulfilled a co-ordinating role over all these local activities which could be broadly defined as being concerned with health and laid the foundations of a comprehensive community health and welfare service. The public health service encompassed the duties and functions of all preventive health measures and the other two branches of the NHS largely ignored this aspect of health care as a result.

Funding for the public health services was partly through local rates and partly from direct government support. There was great variation in the spending pattern on health and welfare from one locality to another and capital assets, many of which were retained by local government when the NHS passed from its sphere of responsibility in 1974, differed in scale and quality.

Hospital and specialist services. The hospital and specialist services, government-funded from general taxation, were administered between 1948 and 1974 through a structured system of boards and

committees which relied heavily on the voluntary services of appointed lay members and the participation of health professionals in management. Regions were defined upon the principle that each should have at least one medical school and associated teaching hospital to form a focus for teaching and research and all that was implied in terms of excellence in medicine. Teaching hospitals were managed by boards of governors on which the universities were strongly represented, and it was through these boards that the responsibilities of the NHS to provide hospital facilities for the teaching of medical students was discharged. The London postgraduate teaching hospitals were also each managed by boards of governors and all were largely independent—employing their own senior medical staff and dealing directly with the Ministry of Health in relation to major capital developments and revenue allocations. Chairmen and members of boards and boards of governors were appointed by the Minister. (See also MEDICAL EDUCATION IN THE UK AND EUROPE.)

The Regional Hospital Boards appointed Hospital Management Committees for the non-teaching hospitals in each Region and allocated revenue, developed capital programmes, and employed senior medical staff at Regional level. Regions undertook the responsibilities for postgraduate medical education which flourished during that period, and it was through this activity that the relationship between Regions and universities was maintained.

After some redefinition of 13 Regions in 1959 in order to match the developing Southampton Medical School, a pattern of 14 English Regions was established which continues (with slight variations in 1974) to the present day. Wales functioned as a single Region as did Northern Ireland, and Scotland had the equivalent of four Regions. The division of functions between the English Regions and the Ministry of Health and the Scottish Regions and the Scottish Home and Health Department was somewhat different, management in Scotland being more directly a government responsibility. Within Regions hospitals were grouped under Hospital Management Committees. At first groups were small, and psychiatric and general hospitals tended to be in separate groups. As time went on, and particularly after the *Mental Health Act 1959, there was a good deal of merging into larger and mixed groups under Management Committees with wider responsibilities. There was amending legislation in 1968 which enabled Management Committees to undertake teaching hospital responsibilities as University Hospital Management Committees. The *National Blood Transfusion Service was run by the Regional Hospital Boards in conjunction with the Ministry of Health.

General practitioner services and other independent contractors. The independent contractor services consisted (as now) of general medi-

cal and dental practitioners, opticians and pharmacists who offered services for NHS patients through contracts made with Executive Councils. These Councils were established broadly on County, Metropolitan, or County Borough scale and their unpaid 30-strong membership was 15 professional and 15 lay. Lists of patients registered with general medical practitioners were maintained as the basis for payment through capitation fees with very limited extra allowances. The other professions were paid through the Executive Councils on an item of service basis, and the financial commitment to this branch of the NHS was open-ended. The Executive Councils' functions were those of contract administration, acting as paymaster according to nationally negotiated scales, and the handling of complaints. There was no planning, research, or educational function and no management function directly related to the independent contractors. Medical and management information systems were not developed as in the other branches of the NHS. A Medical Practices Committee at national level controlled the distribution of general practitioners by influencing new practices and vacancies in a system of 'closed', 'open', and 'intermediate' practice areas. In 1968 the Ministries of Health and Social Security were merged to form the large Department of Health and Social Security (DHSS). Although the NHS became the responsibility of a Secretary of State, and a similar change occurred in Wales in 1969, the structure of the NHS continued as before. The government changes, however, heralded the reorganization of local government which in turn raised the question of its role in the provision of health services.

Changes in community health services. Local government's role in welfare was redefined in 1968 following the *Seeborn Report* (1968). Local Authority Social Services Departments were to be established and these would absorb welfare and children's services creating new boundaries thereby for activities defined as health. This demarcation in an area crucial for health planning, as a preliminary constraint on all subsequent NHS organization, was of profound significance. It is proving difficult, 15 years later, to find the mechanism to rebuild the health and welfare bridges which were broken down at that time. A strong sense was developing in the NHS of the need to bring primary health care, preventive services, and specialist care together to bear upon the growing needs of the elderly and to develop common aims for health and welfare services. Integrated planning and management was seen as the key to the future, and the division of the NHS into three separate branches was believed to be a major obstacle. Quite apart from the question of local government reorganization, therefore, there was a demand for a management structure which would unify the NHS.

The 1974 reorganization. Six years of intensive consultation and study culminated in the reorganization of 1974. During that time it became

apparent that not only were social services slipping from the sphere of influence of health, but also that the position of the independent contractors was unassailable by those involved in planning and management. After two Green Papers (Ministry of Health, 1968; DHSS, 1970) a consultative document (DHSS, 1971), reports on collaboration with local government (DHSS, 1973, 1974), on medical administration (DHSS, 1972), on DHSS reorganization and a White Paper (DHSS, 1972), the reorganized NHS came into effect on 1 April 1974 (NHS Reorganization Act 1973). New Health Authorities were set up throughout the UK and every post in the NHS carrying any management responsibility was affected. The main aim of integration was achieved only in so far as the remnants of the public health service were incorporated from local government into a new NHS management structure. The structure itself was, however, the aggregate of all the options which the long period of study and consultation had produced.

The arrangement in England was for 14 Regional Health Authorities (RHA), covering geographical areas only slightly changed from the previous Regions, with 90 Area Health Authorities (AHAs) accountable to them and matching County Council and Metropolitan Districts. In London some boards of governors for postgraduate hospitals were preserved, accountable directly to the DHSS. Lines of accountability were a great feature of the 1974 structure. An AHA was accountable as a corporate body to the appropriate RHA, but the chairmen were both accountable to the Secretary of State who appointed them. AHAs whose responsibilities included the supervision of one or more undergraduate teaching hospital were known as AHAs (Teaching) or AHAs(T). Authorities delegated functions to multidisciplinary teams of officers as well as to individual chief officers who formed the teams. Teams managed by consensus and were accountable as a team. Regions had one team, Areas had an Area team, also one or more District teams including a general medical practitioner and a consultant, to cover local services by officer management (i.e. there was no member authority for a District). Teams were not accountable to teams and there was no officer line management between Region and Area nor from Area to District officers. Formal committees (Joint Consultative Committees) were established with the aim of ensuring collaboration with the matching local authorities. Community Health Councils (CHCs) were introduced as independent bodies with the right to be consulted as representing the consumer. Professional advisory committees changed their nature—they had formerly been committees of the Boards and Management Committees but now became committees of the professions themselves with a statutory right to be consulted.

The new management arrangements were detailed by a study group of DHSS and NHS

officers, management consultants, and a university research unit whose report was published as the *Grey Book* (DHSS, 1972). This book, which had advisory rather than statutory status, covered objectives, roles, and relationships for Authorities and officers and defined management style and structure. Notwithstanding the scope for variation, the *Grey Book* was closely adhered to in England and its 'red' and 'black' counterparts drawn up for Wales and Northern Ireland respectively were also adopted.

Wales adopted a similar pattern to England and reorganized at the same time, the Welsh Office taking on approximately the same role as the English Regions. Northern Ireland and Scotland reorganized before England with Area tiers (Boards) but no Regional tiers. Common or central services agencies fulfilled some of the functions which in England were undertaken by Regions. Integration of health with personal social services was achieved in Northern Ireland. Arrangements for the independent contractors remained almost untouched in England and Wales by this reorganization. Family Practitioner Committees (FPCs) emerged from the old Executive Councils with similar functions although accountable to AHAs. In Scotland and Northern Ireland former Executive Council functions were taken over by the new Health Boards.

The Regional functions could now be summarized as resource allocation (for Regional purposes and to AHAs including the AHAs(T)), strategic planning, and support for teaching and research. It was intended that all day-to-day management should be undertaken by AHAs who could delegate extensively to officer teams. A feature of the Authorities' business was that it had to be conducted in public and without recourse to committees.

The 1974 reorganization proved almost immediately to be costly and complex. Many of the posts in the new management structure were unfilled for lack of funds. The formal structures involved greatly extended lines of communication, and a network for consultation which slowed decision-making.

The importance of planning care for patient groups at local level and for structures within Districts—sectors and units—began to emerge and a standardized NHS Planning System was developed. A Royal Commission on the NHS, sitting between 1976 and 1979, heard much evidence on the need for simplification and on the apparent failure to have achieved integration. Their report (Royal Commission, 1979) included a recommendation that there should be one organizational tier below Region or Health Department.

By December 1979 the DHSS and Welsh Office had published *Patients First*, a consultative paper on the structure and management of the NHS in England and Wales. DHSS Circular HC(80)8 (1980) launched the further reorganization which was to be effective from 1982.

The 1982 reorganization. The 1982 reorganization was aimed at simplifying the NHS management structure below Regional level and achieving a 10 per cent reduction in management costs in so doing. Very little legislative change was necessary compared with 1974. The 90 English AHAs were abolished and replaced by 192 District Health Authorities (DHAs) directly accountable to the RHAs which were unaffected. Those Districts with continuing responsibility for Teaching Hospitals were recognized for this purpose by their Regional Health Authority but the word 'Teaching' was dropped from their titles. Chairmen of the new Authorities were appointed by the Secretary of State, members by the RHA. Total membership was reduced to a basic 15, but this included nominations from local government authorities in the District and some variations upwards were allowed to take account of the number of local authorities involved. A university-nominated member and not more than three medically qualified members were also included in the total. All members were unpaid in respect of their services but a modest honorarium for chairmen which had been introduced in 1974 was continued.

In Scotland, Wales, and Northern Ireland the 1982 reorganization did not involve the abolition of a management tier but other features of the English reorganization were introduced so that a closely similar pattern of management now exists throughout the UK. The differences are mainly those of terminology, with Northern Ireland continuing its system of combined health and social services. 'Common services agencies' survived in Scotland and Wales for the management of multi-District services which are mostly the responsibility of English Regions. Following several reports on the best means of procurement, a Supply Council (Special Health Authority) was set up for England. Another such Authority was established for NHS training at national level. Ambulances became a District responsibility with some co-ordinating functions at Regional level other than in the Metropolitan situations and in London.

The management pattern for the operational authority (DHA) since 1982 retains most of the features of the 1974 reorganization in a simplified structure. The DHA appoints four officers: medical, nursing, administrative, and finance. These officers are joined by a medical consultant and a general practitioner nominated by their peers, and in teaching Districts by a representative of each medical school concerned. A multidisciplinary team of officers is thus formed which has a collective management responsibility for the District's services. Decisions are taken by consensus and the team as a whole is accountable to the DHA which resolves any failures of the team to form a consensus view. Officers in the team continue to carry individual responsibility for specified professional functions.

A similar team management method is adopted in the English Regions, but the team consists of five

officers appointed by the RHA: medical, nursing, administrative, finance, and works (i.e. there are no clinical, non-officer, members of the team). There is no accountability of the District team to the Regional team or of individual officers from one tier to another. The DHA is, however, accountable to the RHA, while the District and Regional chairmen are both accountable to the Secretary of State.

A further feature of the 1982 reorganization was the development of a management structure within Districts, and this has its counterparts throughout the UK. The new structure is made up of Units which may have geographical, functional, or a mixed make-up. A single hospital or a locality with its catchment population, a defined psychiatric service, or a comprehensive maternity service may all be found as examples of this very flexible management Unit. A nursing officer and an administrator are appointed with management responsibilities at Unit level, and a medical representative is nominated by the profession locally to make a medical management input. In many cases these three individuals function collectively as a consensus-forming management team, but this is not a requirement. Officers in such Unit Management Groups are directly accountable to the District officers of the same discipline, except for the medical members who are accountable to their electorate and in England, except in teaching hospitals, are employed by the RHA.

Financing of the NHS. Capital and revenue funding for the NHS is derived from general taxation and allocated by the government departments to the Regional Authorities in England and to the operational authorities elsewhere. Within England it has been long-standing government policy to effect a fair distribution of funds, and particularly to move funds from the relatively richer south to the less well-off Regions in the north. Little progress was made with this redistribution until a methodology was developed by a Resource Allocation Working Party which reported in 1976 (RAWP, 1976). (Similar reports followed for Scotland, Wales, and Northern Ireland.) The report advocated the calculation of revenue targets which are a per caput share for the population served, greatly modified by adjustment of that population by weightings related to the local need for services. Movement gradually towards targets was intended through the allocations made but the usefulness of the method has been somewhat attenuated by the very limited revenue growth available in recent years. A method of distributing capital also advocated by the Working Party never gained acceptance and after six years of use is being reviewed.

Revenue funding is particularly significant in NHS management as it represents the means by which change can be managerially effected. Politicians, members, and the Community Health Councils tend to point to the level of spending as an

indicator of the level of service although the relationship is far from direct. Authorities are legally required to keep within their annual cash limits, and the cash-limited allocation is a powerful system of control. The performance of the NHS is almost exemplary in respect of its overall cash limit. The other major force in NHS management is the practical approach voluntarily adopted by health professionals in the face of limited resources for meeting health demands. Advisory committees of health professionals (medical, dental, pharmaceutical, and optical being formally recognized) are established at every level and have the right to be consulted and to offer advice. In changing situations, it is peer group pressures, especially within the medical profession, that can speed or obstruct management decisions to effect changes and influence the way in which financial allocations are used. In recognition of this power the NHS has developed a highly participative management style, involving the professionals and predominantly the doctors at every level of decision-making.

At the time of writing the recommendations in the report of a management enquiry undertaken for the Secretary of State by R. Griffiths and presented in the form of a letter with accompanying notes (November 1983) are being implemented. No further legislation or structural change is involved but radical alterations in the DHSS include the setting up of Supervisory and Management Boards concerned with the NHS. There is great emphasis on personal accountability for a general management function which is being introduced at every level of the NHS through the appointment of regional, district, and unit general managers. It is expected that clinicians will become general managers in some instances and will be able to participate in a revised system of management budgeting. The recently introduced system of management review, from level to level up to the Secretary of State's review of Regions is strongly endorsed. This exercise represents a distinct change in management style for the NHS with less reliance on a multi-disciplinary approach and more adaptation of business methods to the management of health services. Whereas cost control has not caused difficulties hitherto, the current search for cost improvements, value for money, and increased productivity seems likely to place the organization under severe pressure. There is, however, considerable scope for diversity in the way the new measures are introduced and no doubt some developments will emerge as worthwhile. The evaluation of the results of management change remains elusive in terms of health and health services.

E. R. RUE

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Further reading

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NATIONAL HEALTH SERVICE (REORGANIZATION) ACT 1973. The 1973 Act made some changes in the arrangements provided for the *National Health Service in the *National Health Service Act 1946. Local health authorities were abolished and their responsibilities including public health and all personal health services were transferred to a reorganized health authority system comprising two tiers, namely, Regional Health Authorities (replacing Regional Hospital Boards) and Area Health Authorities (newly created). Executive Councils were replaced by Family Practitioner Committees, and brought under the control of the AHAs. Two other important changes were: the creation of the office of Health Service Commissioner or 'ombudsman'; and the setting up of *Community Health Councils to represent the 'consumer interest'.

NATIONAL HOSPITALS FOR NERVOUS DISEASES, THE, have arisen from the amalgamation of several hospitals. The National Hospital for the Paralyzed and Epileptic was founded by Louisa Chandler and her sister in 1860 to care for these patients, who were inadequately treated in the general hospitals of that day. It had eight beds in Queen Square in London. Also there is the Maida Vale Hospital, founded as the London

Infirmiry for Epilepsy and Paralysis by Dr Julius Althaus in 1866, which was originally in Marylebone, moving to its site in Maida Vale in 1903. These two hospitals were responsible for the founding of neurology and neurosurgery as independent specialties in the UK. In 1948, with the advent of the *National Health Service, they were amalgamated under one Board of Governors, becoming then the National Hospitals for Nervous Diseases. The research and postgraduate medical educational activities were brought together in 1951 under the Institute of Neurology, as part of the British Postgraduate Medical Federation, which is a school of the University of London. Later came the incorporation at Finchley of occupational therapy and physiotherapy facilities (1976). The Audrey Fleming Speech Therapy School in Hampstead and the West End School in Portland Place have combined (1972) and are now the National Hospitals' College of Speech Sciences, the only one of its kind in the UK.

Among the great names in neurology to have worked in these hospitals were John Hughlings *Jackson, David *Ferrier, Henry *Head, Charles Edouard *Brown-Séquard, James Collier, S. A. Kinnier *Wilson, and Gordon *Holmes, while in the early years of neurosurgery Victor *Horsley was pre-eminent.

NATIONAL INSTITUTE FOR MEDICAL RESEARCH.

The National Institute for Medical Research (NIMR), Mill Hill, London, is the UK *Medical Research Council's major institute for research in the basic laboratory sciences subserving medicine. The concept of such an institute dates from the beginning of the Council itself, immediately prior to and following the First World War. The first of the Institute's two sites, at Hampstead, was occupied in 1920; in 1949, it moved to larger purpose-built accommodation in Mill Hill, six miles further north of central London.

Many noted biomedical scientists have worked for shorter or longer periods at the NIMR. The first three directors, spanning the period from 1928 to 1971, were in order Sir Henry *Dale, Sir Charles Harington, and Sir Peter Medawar. Among the many topics upon which major research achievements have been either initiated or developed there may be mentioned: the methonium compounds which provided the first effective treatment of *hypertension; the isolation of *ergometrine; many physical methods including *ultramicroscopy and gas *chromatography; *protein synthesis; *vitamin D; virology, particularly with respect to *influenza and transmissible tumours; *immunology; *insulin and *carbohydrate metabolism; sex *hormones and reproductive physiology; environmental physiology; and methods for biological standards and control. (See also RESEARCH INSTITUTES.)

NATIONAL INSTITUTES OF HEALTH (NIH) arose out of a small bacteriological laboratory at

the Marine Hospital, Staten Island, New York, established by the US government. It was for research into 'cholera and other 'infectious diseases. For its first 25 years it concentrated on these though in 1891 it moved to Washington, DC, as the Hygienic Laboratory. It gradually expanded its interests into 'public health under the auspices of the US Public Health Service. In 1930 the name was changed by enactment to National Institute of Health, with the wide remit of 'ascertaining the cause, prevention and cure of disease'. Later the NIH moved to Bethesda, Maryland, where it now employs a staff of about 12 000, some in the Clinical Centre. As funding for research has become increasingly a government concern the administration was handed over to the NIH, which supports research in universities, hospitals, and medical centres of all kinds. The funds used for this purpose now amount to \$3150 million annually. With the addition of the National Heart Institute, the National Cancer Institute, and some others the enterprise became the National Institutes of Health. See also RESEARCH INSTITUTES.

NATIONAL INSURANCE ACT 1946. This was one of the enactments which arose out of the 'Beveridge Report and which formed the legislative basis of the British version of the 'welfare state' that has existed since 1948. The Act, which was largely replaced by the National Insurance Act 1963, established an extended system of national insurance providing pecuniary payments by way of unemployment benefit, sickness benefit, maternity benefit, retirement pension, widows' benefit, guardian's allowance, and death grant; it also provided for the making of payments towards the cost of a 'national health service. Earlier legislation regarding unemployment insurance, national health insurance, widows', orphans', and old age contributory and non-contributory pensions was repealed by the Act.

NATIONAL INSURANCE (INDUSTRIAL INJURIES) ACTS. These UK Acts, beginning with that of 1946, replaced the Workmen's Compensation Acts 1925-45, repealing most of their provisions, and established a system of compulsory insurance against personal injury caused by accidents arising out of and in the course of an insured person's employment and against prescribed diseases and injuries due to the nature of a person's employment. Compensation was in the form of insurance benefits administered by the state. Compensation in respect of employment prior to the operation of the Act (i.e. to 1946) has been retained under the Industrial Injuries and Diseases (Old Cases) Act 1975. The Acts were in turn superseded by the Social Security Acts of 1975 and 1978.

NATIONAL MEDICAL ASSOCIATIONS. See MEDICAL COLLEGES, ETC. OF THE UK; MEDICAL INSTITUTIONS, ETC. IN THE USA AND CANADA.

NATURAL CHILDBIRTH, also known as the Grantly Dick Read method of childbirth, was first advocated by Read in 1933. The principle is the avoidance of pain and muscular tension by relaxation methods which allow the birth to proceed naturally and render 'analgesic drugs unnecessary. Some advocates of natural childbirth feel also that the mother should be allowed to choose her own posture during labour.

NATURAL SELECTION is the process by which life forms best adapted to their environment survive and reproduce in the greatest numbers, propagating their 'genetic characteristics. Genetic 'mutations producing new characteristics favourable to survival and reproduction are propagated, those unfavourable are not.

Charles 'Darwin in 1859 proposed natural selection as the principal mechanism of evolutionary change and hence as the origin of species.

NATURISM is a movement based on the practice of communal nudity in private grounds or on beaches set aside for the purpose.

NATUROPATHY is a system which eschews the use of medicinal drugs and the consumption of other than 'natural' foods.

NAUNYN, BERNHARD (1839-1925). German clinical physician, MD Berlin (1863). Naunyn was professor of clinical medicine in Strasbourg, and also in Dorpat, Berne, and Königsberg. His special interest was in metabolism and diseases of the liver and pancreas, and 'diabetes mellitus.

NAUSEA is an unpleasant sensation of being about to vomit, sometimes culminating in the act of vomiting. The original meaning was seasickness.

NAVY, ROYAL: MEDICAL SERVICES

Origins. Prior to the 16th c., sick and wounded seamen were nursed in hospitals on the Channel coast, which were independently endowed, owned by the town or attached to religious houses. With the decline of the monasteries towards the end of the 15th c., independent almshouses were provided by mariners' guilds at Hull, Newcastle, and Bristol. Elsewhere, the sick were quartered in private houses and inns under government contract or were admitted to 'St Bartholomew's and 'St Thomas's hospitals in London. During the early Tudor period, seamen continued to receive pay while sick and, if discharged, were given travelling expenses and a small terminal grant. Howard, Drake, and Hawkins, concerned about the plight of seamen after the Armada battle, established the Chatham Chest in 1590 as an independent charity supported by subscriptions of sixpence a month from all seamen; this was the earliest form of health insurance. In 1592, Sir John Hawkins founded his hospital in Chatham to provide twelve almshouses

for pensioners and Elizabeth's Poor Law Act of 1601 included provision for wounded seamen. Fifteenth-century voyages of discovery and Henry VIII's revolutionary innovations in shipbuilding and naval gunnery resulted in ships of greater size, firepower, and seakeeping capability, with augmented crews living in overcrowded conditions and exposed, not only to wounds and burns from missiles, splinters, and gun explosions, but also to devastating epidemics. *Plague and *dysentery were first recorded in 1545 (Oppenheim, 1896). *Scurvy appeared with the long Elizabethan voyages, and *typhus resulted from the activities of the press-gang in time of war. An epidemic of dysentery in 1588 led to the appointment of two physicians and one, Roger Marbeck, subsequently sailed with the fleet to Cadiz.

Henry VIII was first to realize the need for a permanent medical service at sea. Lists of surgeons in his navy royal appear throughout his reign, co-ordinated by the Company of Surgeons. The first evidence of a structured medical service is provided by the Cotton MSS (Galba, BIII, fol. 154, British Library), which lists the pay of the chief surgeon, of eight 'other surgeons being most expert', and of more junior surgeons, who served in Howard's fleet against France in 1512 or 1513. Certainly, in 1513, there were 32 naval surgeons serving under four masters and a chief surgeon (Exch. Accts, 56(10), 1513, Public Record Office). Henry's pharmacopoeia of plasters and ointments (Sloane MSS 1047, British Library) appears to have been used by naval surgeons. It marked a break with classical tradition by introducing simple practical remedies.

Evolution and structure. The size and complexity of Henry's navy required an effective administration and Henry created a Navy Board in 1546. Naval surgeons served their apprenticeship with masters of varying calibre, but were examined and appointed by the London Company, on behalf of the Board which granted their warrants, to ships appropriate to their qualifications and experience. A liaison between the Board and Surgeons' Hall was established, in the Elizabethan era, by William Clowes, who acted as *de facto*, if not *de jure*, surgeon-general. He served in the flagship *Ark Royal* against the Spanish Armada in 1588 and, in that year, published the first book on naval surgery. This was based upon 20 years of sea experience, and established the practical and sturdily independent tradition of naval medical writing. Clowes was followed, under the early Stuarts, by John *Woodall, first surgeon-general of the East India Company, whose book, *The Surgeon's Mate* (1617), listed the contents of the surgeon's chest, described the use of his instruments and called for high professional standards, continuing postgraduate education, and a journal of clinical practice. Woodall was probably responsible for ensuring that the 1629 barber-surgeons' charter of Charles I provided for the mandatory

examination of sea surgeons at Surgeons' Hall and for the inspection of their chests and instruments, towards the cost of which the surgeon was awarded a 'free gift'. Woodall was succeeded by James Pearse, who became the first official surgeon-general of the Navy in 1670 and followed Knight as surgeon-general of the Forces in 1680 to establish a joint directorate of Army and Navy medical services until William's accession in 1688. From 1703, chests were supplied by the *Society of Apothecaries and Queen Anne's Bounty, which replaced the free gift, was given presumably to meet their increased cost.

The Dutch wars of the 17th c. demonstrated the need for a central medical department to co-ordinate arrangements for the reception, treatment, and disposal of casualties. The first of six wartime Sick and Hurt Boards was established in 1653 and took over surgeons' appointments. Whereas continuity was provided by senior surgeons and, later, the surgeon-general, physicians were often responsible for regional arrangements and medical advice to the Board until, in 1654, Cromwell chose Paul de Laune as first physician of the Fleet. During this period, naval sick quarters were established in home ports and, later, overseas. They were administered by a 'Surgeon and Agent'. Surgeons also held permanent appointments in naval dockyards. The Fifth Board (1702) was given responsibility for prisoners of war and acted with the scrupulous care and impartiality of the *Red Cross today. The Sixth Board (1740) was not dissolved, but continued throughout the wars of the 18th c. In 1796, its prisoner-of-war commitment was transferred to the Transport Board with which the Sick and Hurt Board was itself amalgamated in 1805. The Transport Board with its single remaining medical commissioner was absorbed into the Victualling Board in 1817. Sir William Burnett, an able administrator, became its physician in 1822. When the Admiralty Board was reorganized in 1832, Burnett was made Physician-General of the Navy to head an independent medical department. In 1841 he was styled Inspector General of Hospitals and Fleets, and in 1844 Director-General of the Medical Department of the Navy; this marked belated recognition by the Admiralty of the value of professional men. Surgeons did not achieve commissioned rank and a uniform until 1805, and assistant surgeons had to wait until 1855 for these privileges. Staff Surgeons were introduced in 1855 and Fleet Surgeons—a grade higher—in 1875, in order to prove parity with the Army and reward experience and responsibility. Agitation for better conditions of service continued until the highly professional service of recent years was established. In 1918, surgeons were given the equivalent executive rank that they still hold: surgeons entered as Surgeon Lieutenants; Staff Surgeons became Surgeon Lieutenant Commanders; Fleet Surgeons, Surgeon Commanders; Deputy Inspectors, Surgeon Captains; and Inspectors General, Surgeon Rear-Admirals. The

Medical Director-General has since held the rank of Surgeon Vice-Admiral and is accountable to the Admiralty Board through the Second Sea Lord. Today, approximately 370 medical officers hold commissions of varying length. A large reserve, representing every medical specialty, is used to augment training, research and clinical care at home and overseas and can be readily integrated into emergency surgical teams in support of operations by Royal Marines.

Hospitals. A need for hospitals became evident during the 17th c. when fleets were deployed far afield. The *Goodwill*, a hospital-storeship, supplied a solution in the Mediterranean in 1625 and hospital ships have been employed ever since, enjoying particular success in both World Wars and in the Falklands operation of 1982. The heavy casualties of the three Dutch wars overwhelmed local facilities, and naval hospitals appeared at Rochester in 1666 and Plymouth in 1673. There were probably others and the Commonwealth, in 1642, also requisitioned Henry VII's Savoy Hospital and Ely House in London. The large number of disabled led William III to develop Greenwich Palace as a hospital for naval pensioners in memory of Queen Anne. Under naval executive, rather than medical, administration, standards of hygiene and care rapidly deteriorated, in contrast to its infirmary for those acutely ill, under medical direction, which a Royal Commission in 1860 found efficient and spotlessly clean. The infirmary became the Dreadnought Seamen's Hospital in 1870 and Greenwich Hospital passed to the Royal Naval College in 1873. Haslar Hospital (Fig. 1) at Gosport, with accommodation for 1800 patients, was built between 1746 and 1762 and a new hospital at Plymouth for 950 patients, between 1758 and 1762. They were administered by the senior physician and a council. The Melville Hospital at Chatham (1827-8) was superseded by a new hospital in 1905, while Great Yarmouth Hospital (1809) became the naval asylum in 1863. With the territorial gains of the 18th c., overseas hospitals were established and, by the end of the century, there were naval hospitals at Haslar, Plymouth, Chatham, Yarmouth, Cork, Portland,

Deal, in Scotland, Malta, Halifax, Victoria, Jamaica, Bermuda, Cape Town, Trincomalee, and Hong Kong. Today, hospitals remain only at Haslar, Plymouth, and Gibraltar. Executive officers were installed as governors of Haslar and Plymouth in 1794. With a few notable exceptions (Parry at Haslar), they were not a success. They brought discipline and better organization, but also pomposity, interference, and the imposition of unworkable dockyard routines until, in 1870, following a civil commission on naval hospitals which found the medical arrangements admirable, they reverted to medical administration under Inspectors-General.

Nursing. Until the end of the 18th c., nursing on board ships was provided by 'loblolly boys' (loblolly was a kind of porridge); they were seamen or marines of good character. From 1808, a separate sick berth below the forecabin was established. In hospital ships, an all-male sick watch had been the rule since 1703, with women used for domestic duties only, although, assisted by pensioners, some nursed in hospitals. In 1853, sick-berth staff were provided for all sea-going ships and, in 1854, men replaced women in hospital. The Sick Berth Branch, recruited primarily from boys of Greenwich Hospital School, stemmed from the Hoskins Committee of 1883. With a recognized career structure, it was the forerunner of the modern Medical Branch with its medical assistants and technicians.

Elizabeth Alkin devoted all her private resources to the nursing of wounded sailors during the Dutch wars and, during the Crimean war, three naval hospitals operated under a matron and two nursing sisters to achieve an excellent health record. The Hoskins Committee recommended a female nursing service, which was established in 1885 and developed into Queen Alexandra's Royal Naval Nursing Service in 1902, accepting suitably qualified male (naval) nurses in 1982.

Reformers. The evolution of the modern naval medical service has been due entirely to the courageous efforts of scientifically orientated medical officers in the face of Admiralty hostility. In the process, the sailor has been the principal beneficiary, for almost every improvement in his health, diet, and conditions of service has derived directly from individual medical initiative. Clowes, Woodall, Wiseman, Yonge and Moyle made important contributions to surgery during the 17th c. Their emphasis upon professionalism, clinical observation and record-keeping led directly to 18th and 19th c. reforms, spearheaded by James Lind (Fig. 2) and his disciples, Sir Gilbert Blane and Thomas Trotter. Lind towers above them all and is specially remembered for the world's first controlled clinical trial, which he conducted on board HMS *Salisbury* (Fig. 3) in 1747, to prove the power of oranges and lemons to cure scurvy in matched scorbutic cases on a scorbutic diet. His *Treatise of the Scurvy* (1753) described the pathological



Fig. 1. Royal Navy Hospital, Haslar.



Fig. 2. Dr James Lind, after a portrait painted upon Lind's retirement from the Royal Naval Hospital, Haslar, in 1783

features, scurvy's association with other nutritional disorders, and the adverse influence of environmental and psychological stress; it included a masterly review of the world literature. His *Health of Seamen* (1757) provided the basis of modern sanitary science and his *Hot Climates* (1768), the first authoritative handbook on tropical medicine. At Haslar, Lind lowered the rate of hospital infection, introduced high-energy/protein diets with vitamin-rich foods of high fibre content and demonstrated an enlightened administration. He showed the feasibility of distilling sea water, was first to demonstrate the clinical signs and correct treatment of hypothermia, and described modern methods of resuscitation. Although they were ignored by the Admiralty until Blane became a commissioner of the Sick and Hurt Board in 1795, the introduction of Lind's measures

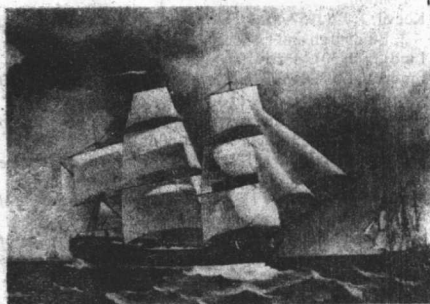


Fig. 3 HMS Salisbury, from a painting by Leonard Pearce

contributed as significantly to the defeat of Napoleon as their adoption by Captain Cook led to the success of his three great voyages of discovery between 1768 and 1779. Scurvy and typhus were eliminated from the fleet and the incidence of malaria and of yellow fever was markedly reduced. Blane (1815) claimed that the number of sick fell by 75 per cent between 1806 and 1811. His pursuit of medical audit was taken up by statisticians such as Robertson and Bryson, and the *Health of the Navy Statistical Reports* from 1830 reflected this favourable trend.

Postgraduate education. Lind wrote his first paper for the Association of Surgeons of the Royal Navy, an intellectually active group founded in 1746 to advance knowledge of the sea diseases which had caused devastating mortality during Anson's circumnavigation (1740-4). This group had rooms in Covent Garden and William Hunter as lecturer, and followed the tradition established during the Dutch wars, of surgeons holding ship-board clinical meetings after each engagement. Cockburn attempted to put such informal gatherings on an official basis by using hospital ships for postgraduate teaching; this was one of a number of reforms that he proposed in 1702, which were rejected by the Admiralty. Meetings continued in ports and, in 1732, John Atkins propounded a scheme for a postgraduate medical centre in Portsmouth Naval Academy. No more was heard about the Association after 1762, but the gold medal it awarded for the best case presentation was endowed by Sir Gilbert Blane and is still given for outstanding work. The *Journal of the Royal Naval Medical Service* is the Association's natural successor. Trotter, in 1797, recognizing the teaching potential of Haslar, advocated medical libraries and a museum, finally established in 1827, when Sir William Burnett installed Dr Scott as lecturer and librarian at Haslar with a museum curator. Courses of lectures were held until 1871, with naval medical officers attending the new Army medical school, until a naval medical school was established in Haslar in 1881.

The influence of this long period of medical education was reflected in the calibre of the doctors it produced. The health and welfare of convicts during voyages to Australia were transformed by the appointment of Surgeon-Superintendents. The antislavery patrols of the West African Squadron were possible only because of the preventive measures practised by its surgeons, who contributed materially to knowledge of tropical diseases. Nineteenth-century polar expeditions produced the surgeon-naturalist, typified by Sir John Richardson, who made valuable contributions himself and collaborated closely with Darwin, Hooker, and Huxley. Sir Thomas Spencer Wells dramatically reduced operative mortality in his London hospital by introducing naval standards of hygiene and ventilation.

The modern medical service. Alexander

Turnbull, Inspector-General at Haslar in 1897, deserves the credit for courageous initiatives which ultimately provided the highly professional service of the 20th c. His influence in the Durnsford Committee resulted in the transfer of the medical school to the Royal Naval College at Greenwich in 1912, where access to College departments and to patients with tropical diseases at the Dreadnought Hospital stimulated research, notably that of Sheldon Dudley into the epidemiology and prophylaxis of diphtheria, and that of Rainsford on typhoid vaccine. On the outbreak of the Second World War, the school moved to Clevedon in Somerset and, after the war, to Monkton House, Alverstoke, Gosport.

The increasing number and complexity of maritime medical specialties during the 1960s required rapid expansion of research and training facilities. To meet this need, a new 'Institute of Naval Medicine was developed on the Alverstoke site in 1969, with responsibility for postgraduate training and research vested in a Surgeon Rear-Admiral who became the first Dean of Naval Medicine. Training in the various maritime specialties is co-ordinated by a Director of Studies in collaboration with the professor of naval hygiene, who is responsible for training and research in naval occupational medicine, and with the professors of naval medicine and surgery, who hold joint appointments with their respective Royal Colleges and with the Institute and Haslar Hospital. They control research and postgraduate training in naval hospitals, which now offer naval medical officers a wide spectrum of clinical experience as there is also a 50 per cent intake of civilian patients. A Director of Medical Staff Training in Haslar co-ordinates the training of medical ratings, including that of state-registered and state-enrolled nurses in conjunction with QARNNS tutors. The Institute team of doctors, physiologists, physicists, psychologists, chemists, and statisticians provides operational support for the fleet. This includes radiological and environmental safety surveillance, radiochemical analysis, mobile mass miniature radiography, the investigation of factors affecting men in relation to their working environment, and control of toxicological and biological hazards in ships and dockyards. Mobile units are immediately available in case of diving and radiation accidents, and for control of epidemics. Research is supervised by Clinical and Environmental Working Parties of medical staff, university consultants, and representatives of the Royal Naval Personnel Committee of the 'Medical Research Council. Projects relate to diving, the submarine atmosphere, nuclear radiation, anthropometry, noise, vibration, motion sickness, performance under stress, and survival in extreme conditions. Clinical research centres upon diseases with a high incidence in seamen, such as renal and gastroenterological conditions. The Institute's medical research unit in Devonport dockyard undertakes epidemiological studies in industrial diseases, and dental requirements are

met by a Director of Dental Training and Research. Collaboration with similar American, Canadian, and French institutes has proved to be mutually beneficial and cost-effective.

The increasing diversity of maritime medicine led to reorganization of the Medical Director-General's department in 1973 under Directors of Personnel and Logistics, Health and Research, and Naval Dental Services, with the Matron-in-Chief responsible for nursing services. The medical service was restructured in 1975, with the Dean of Naval Medicine co-ordinating research and training, the Surgeon Rear-Admiral (Naval Hospitals) responsible for clinical standards and practice, and the Surgeon Rear-Admiral (Ships and Establishments) overseeing general practice, the occupational health service in dockyards, and command staff officers who act as community physicians. Emphasis upon triservice collaboration gained impetus from the Defence Medical Services Inquiry Committee's recommendations in 1973. Consultant Approval Boards, the Armed Forces Medical Advisory Board, triservice schools for physiotherapists, radiographers, laboratory technicians, and dental hygienists and a triservice Directorate of Medical Policy and Plans are examples of a continuing trend. From 1985 a Defence Medical Services Department has been established under a single (triservice) Director-General. (See also ARMY, BRITISH: MEDICAL SERVICES; AIR FORCE, ROYAL: MEDICAL SERVICES.)

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NECROBIOSIS is the formation of circumscribed degenerative lesions of skin *collagen, seen particularly in diabetic patients.

NECROLOGY. A death roll, an obituary notice, or a history of the dead.

NECROMANCY is the prophesying of future events by supposed communication with the spirits of the dead.

NECROPHILIA is a pathological liking for dead bodies, or a sexual perversion involving intercourse with corpses.

NECROPSY. Synonym for *autopsy.

NECROSIS. Death of tissue.

NECROSIS, AVASCULAR. *Necrosis due to failure of blood supply.

NEEDLE. Any slender sharp metal instrument for puncturing or suturing; or when hollow, for injecting or aspirating.

NEGATIVISM is pathological resistance to suggestion; in pronounced cases the patient does the opposite of what he is asked to do. The same term is sometimes used to denote an abnormal state in which a patient consistently does what he ought not to do (with food, faeces, etc.).

NEGLIGENCE is an act or state of being neglectful, of duty, dress, cleanliness, etc. See also PROFESSIONAL NEGLIGENCE; LAW AND MEDICINE IN THE UK; LAW AND MEDICINE IN THE USA.

NEGRI, ADELCHI (1876-1912). Italian pathologist, MD Pavia (1900). While assistant to *Golgi, Negri discovered the *rabies corpuscles (Negri bodies) in the pyramidal cells of *Ammon's horn in the brains of animals dying of rabies. They are recognized as pathognomonic of this disease. Negri died of pulmonary *tuberculosis aged 35.

NEGUS, SIR VICTOR EWINGS (1887-1974). See OTOLOGY.

NEISSER, ALBERT LUDWIG SIEGMUND (1855-1916). German dermatologist and bacteriologist, MD Breslau (1877). Neisser discovered the bacterial cause of *gonorrhoea, since named *Neisseria gonorrhoeae*.

seria gonorrhoeae. This was in 1879 when pelvic infections and vaginal discharges were not understood. He also investigated syphilis and worked with his friend Paul Ehrlich on the use of arsenicals; he strongly advocated the therapeutic value of mercurials, which help prevent the worst manifestations of *neurosyphilis. In 1880 he identified *Mycobacterium leprae* which Hansen had seen in 1873 but had not thought to be the cause of leprosy. He was associated with von Wassermann in devising his serological test for syphilis.

NEISSERIA is a genus of aerobic gram-negative *diplococci which includes the important pathogens of *gonorrhoea (*Neisseria gonorrhoeae*) and *meningococcal meningitis (*N. meningitidis*).

NÉLATON, AUGUSTE (1807-73). French surgeon, MD Paris (1836). In 1831 Nélaton became professor of surgery at the Hôpital S. Louis. Nélaton, who was surgeon to Napoleon III, was highly regarded as a skilled, wise, and knowledgeable surgeon of unimpeachable integrity and unwavering courtesy. He introduced the rubber *catheter (1860) and was one of the first to use the electrocautery. He popularized *ovariotomy in France and invented a bullet-seeking probe which was first used on Garibaldi at Aspromonte in 1862. A line joining the anterior superior iliac spine and the ischial tuberosity is still commonly called Nélaton's line.

NEMATODE. Any member of the large phylum Nematoda, which consists of roundworms, threadworms, and eelworms, many though not all being endoparasitic in plants and animals. Those of medical importance include **Ascaris*, **Strongyloides*, **Ancylostoma*, **Toxocara*, **Trichinella* (the agent of *trichiniasis); the several species causing *filariasis, and some others.

NEOMYCIN. A member of the *aminoglycoside group of antibiotics with similar characteristics to the others, except that it is considered too toxic to be administered parenterally. Its use is therefore confined to topical application in infections of the skin and mucous membranes, and to sterilization of the intestine prior to bowel surgery or in hepatic failure.

NEONATE. An infant during the first four weeks of life.

NEOPLASM. Any tumour or new growth, whether or not malignant. See ONCOLOGY.

NEOSTIGMINE is a synthetic quaternary ammonium compound with cholinergic effects, of value in the treatment of *myasthenia gravis and other conditions. It is an *anticholinesterase; that is it acts by inhibiting the enzyme which destroys *acetylcholine.

NEPHELOMETRY is the optical measurement of turbidity in suspensions by means of light scattering.

NEPHRECTOMY is the surgical removal of a kidney.

NEPHRITIS is any inflammation of kidney tissue. When otherwise unqualified, nephritis is usually taken to mean one of that group of disorders collectively known as glomerulonephritis. See NEPHROLOGY.

NEPHROGRAPHY is the radiographic visualization of the kidneys, on plain X-ray films or with the assistance of *pyelography, *arteriography, or *computed transaxial tomography.

NEPHROLITHIASIS. The presence of *calculi within the kidney and upper urinary tract.

NEPHROLOGIST. A specialist in diseases of the kidney.

NEPHROLOGY

Terminology. Etymologically, 'nephrology' should mean 'knowledge of the kidney'—no more and no less. But as the term is actually used, it is virtually synonymous with 'medical diseases of the kidneys'. This usage implies two important exclusions: first, the structure and function of the kidneys except in so far as they relate to the manifestations of renal disease; and secondly, those disorders of the kidney which are commonly referred to surgeons, thus entering the realm of urology, together of course with disorders of the urinary tract which conveys *urine from the kidneys to the outer world. On the other hand, nephrology is not an island within the medical domain: it is therefore not possible to give a coherent account of it without touching on related matters, such as general disorders which may affect the kidney; the effects of renal disease on other systems of the body; and—even more generally—the relationship between kidney disease and that failure to preserve normal body composition which is one of the hallmarks of renal insufficiency.

Historical aspects. The recognition of nephrology as a particular specialty within medicine is comparatively recent, say within the past 20–30 years. Let us leave the causes of this specialization until later; this section will outline the growth of knowledge of renal disease up to the present date.

Individual manifestations of renal disease, such as *haematuria, *dropsy, and uraemic coma, have been observed, even if not recognized, from the earliest times; the particular association between small shrunken kidneys and chronic illness was known both to Greek and to Arab medicine. Among the dark sayings in the *Hippocratic writing we come on 'Colourless urine is bad'; but we

cannot tell whether this is the 'badness' of chronic renal failure, or that of *diabetes mellitus.

The ancients were greatly handicapped by their adherence to the theory of the four *humours, and by the lack of chemical methodology, so that they were neither predisposed nor competent to explore the more mundane chemical dimension which is so important in the study of renal disease. In the 17th and 18th c., however, systematic observation of disease in individual patients was encouraged by *Sydenham and *Boerhaave; modern chemical ideas began to be developed, and appropriate methods devised; and the attitudes of the enlightened weakened the hold of authority. Clinically, associations of symptoms were beginning to be more clearly recognized—the association of acute nephritis with scarlatina ('scarlet fever'); of dropsy with coagulable urine; and of chronic illness and early death with contracted kidneys. Chemically, analysis had advanced to the stage where it was possible for *Bostock to show that the presence of *albumin in the urine could be matched by a deficiency of albumin in the blood, and that in chronic renal failure there was an excess of *urea in the blood.

By the start of the 19th c. the more sinister forms of renal disease were familiar not only to doctors, but to the educated layman. For example, Sir Walter Scott shortly before his death in 1832 confided to his journal that: 'within these three days I have passed (you may alter the vowel A to the vowel I) a formidable quantity of blood. When a man makes blood instead of water, he is tempted to think of the possibility of his soon making earth.'

The time was thus ripe for the contribution of Richard *Bright of *Guy's Hospital, a contribution so remarkable as to have linked his name forever with that most characteristic of renal diseases, glomerulonephritis (Bright's disease; see below). The quality of the advance made by Bright can be fully assessed only if we consider the difficulty inherent in the study of a disease, or more accurately a group of diseases, which may appear either with dramatic suddenness as haematuria or dropsy, or on the other hand may not be detected until the kidneys have totally failed; which may last for only a few weeks, or for upwards of 20 years; whose outcome ranges from complete recovery to irreversible renal failure; and in which the kidneys after death are most commonly shrunken, but may on the other hand be enlarged. Richard Bright himself summarized his endeavour as 'to connect accurate and faithful observations after death with symptoms displayed during life', in consequence of which saying he has sometimes been described as the pioneer of clinicopathological correlation. This is both more and less than the truth. Of course, Bright was preceded by *Vesalius in the matter of clinicopathological correlation, but he added to it his own very particular contribution—of making, recording, and reporting detailed observations on patients, some of whom were followed for many years. This was Bright's essential contribution, but